

ΠΡΟΔΡΟΜΟΣ ΕΚΛΙΨΙΣ
BEING
A Philosophical DISSERTATION
ON THE
Doctrin^e of ECLIPSES.
EXPLAINING

The *Physical Cause* thereof in each Luminary.

With a Perfect Account of the Time, Quantity,
and Manner of Appearance of those very
remarkable ECLIPSES that will happen on
September the 9th, and *February* the 18th, next.

Also a few Words on the

PYTHAGOREAN SYSTEM;

Wherein is demonstrated the *Heliocentrick* and *Geocen-
trick* Motions of the PLANETS, and the true
Cause of their Retrogradation; particularly the Planet
Mercury, at the Middle of the great *Solar Eclipse*.

With an *Enquiry* into the Nature and Laws of

C O M E T S;

And whether we may expect the speedy Appearance
OF ONE.

THE SECOND EDITION.

By THOMAS FRANKZ, M. D.

*Cœlestem ergo admirabilem ordinem, incredibilemque
constantiam, ex qua conservatio et salus omnium omnis
oritur, qui vacare mente putat, ne ipse mentis expers
habendus est.* ————— Cicero.

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and the fact that the evidence is not in any way
a full and complete account of the time, quantity
and amount of the evidence of the very
evidence of the fact that will happen
a moment ago and before the fact.

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SECRETARY OF THE ARMY

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(Continued)

T O
Her Royal and most Serene HIGHNESS

AUGUSTA

PRINCESS of WALES.

MADAM!



HE Subject I have wrote upon, (however I have discharged myself as an Author) is the most sublime of all human Learning, and may justly challenge the most excellent of the Earth for its Patron; therefore do I in all Humility presume to inscribe these Sheets to Your sublime Highness, whose extraordinary Merits, and most transcendent Virtues, equal to your Birth and Marriage, render you at once the Praise and Admiration of all Mankind who have been happy enough to be informed of your excellent Character.

*When I was Student in a University of your Neighbourhood, * you was then the shining Ornament of the most illustrious House of SAXE-GOTHA, and the most celebrated Princess in that Part of the World.*

* Hall in Saxony.

You

DEDICATION.

You are now happily join'd to a most excellent and heroic Prince, who is destin'd, in conjugal Felicity with your Highness, to make happy (we hope to all future Ages) the Inhabitants of a very powerful and flourishing Empire.

To you, therefore, most excellent Princess, do I dedicate this small Treatise, wishing it may be an agreeable Amusement in an Hour of Retirement; and that you may in every Respect enjoy your Fill of Felicity Here and Hereafter.

I am,

May it please your Royal Highness,

Your most devoted

Humble Servant.

THO. FRANKZ.



A

Philosophical Dissertation

ON THE

Doctrin of ECLIPSES.



S there is no Part of mathematical Literature so excellent as Astronomy, so is there nothing in that delectable Science more sublime and worthy our Contemplation than the Doctrine of Eclipses, which indeed is the Superstructure of Astronomy, and has justly the Precedency of all human Learning. What a field for Speculation,
 B Admiratation,

Abmiration, and Contemplation is opened to our view! How can we behold the wonderful Phenomenon (tho' frightful to the ignorant) without being filled with rapture and amazement at the Mercies as well as Wisdom of God?

At his Wisdom, in regard of the admirable structure of the Universe, and the wonderful harmony throughout the whole Creation; more especially reflecting on the wise Laws whereby all created Beings, whether celestial or terrestrial are governed; with, what order and regularity these stupendious Bodies move in their respective Orbs, executing the orders of the omnipotent Creator to the confusion and amazement of all Flesh, which, tho' animated by a Ray of his Divinity, and favour'd with a Revelation of his Will, are more remiss in their duty, and much more negligent in their high Office, than even those inanimate Beings.

At his Mercies, in regard of the Benefits that accrue to mankind from the Eclipses of the Luminaries, particularly
their

their help to settle Chronology, and rectify the mistakes of Historians that writ many Ages ago; and what is of greater utility, they are necessary to define with competent certainty the Longitude of places on the terraqueous Globe, which is a thing of very great moment not only to Geography, but the most useful and important Art of Navigation. To which may be added, they serve to demonstrate the spherical Roundness of the Earth, and many other Articles of importance to mankind, which were necessary to be known, yet no otherwise resolvable than by this curious Doctrine which I am now about to explain.

An Eclipse is either the hiding, or at least darkening the Luminary by the interposition of some opake Body, or the shadow of such Body. As for example: In a solar Eclipse, the dark Body of the Moon passing between the Eye of the Observer and the Sun, is the sole Cause of that Phenomenon; as is the situation of the Moon, in regard of the

Sun, and place of Observation, the reason of its appearing partial or total. For tho' the Sun may be totally hid from the Inhabitants of one particular City, or tract of a Country; yet to those of another part, at even but a few miles Distance, there will appear a thread of Light, either on the upper, or under limb of the Sun, according to their situation north or south, and this is owing to the small proportion the Moon bears to the Sun and Earth.

Indeed this Phenomenon is very improperly called an Eclipse of the Sun; for that great fountain of Light and Heat is no way effected, but the Earth really is effected and eclipsed. For as it would appear ridiculous, when there is an Eclipse of the Moon, for her Inhabitants to say the Earth (which is the real cause thereof) is eclipsed, so is it as great an impropriety with us to say the Sun is.

But the Eclipses of the Moon are quite different; for being an opaque Body, having no light but what she receives

ceives from the Sun, it is her accidental falling into the Earth's shadow that deprives us of her reflected light, and not being hid from us by the interposition of any other Body, as is the case in solar Eclipses, but altogether owing to the Earth's interposition between the Sun and her; for all dark Bodies exposed to the direct Light of the Sun cast a shadow behind them, which is nothing but the loss or privation of Light in the space opposite to the Sun, by reason the Sun's Rays are intercepted by the opaque Body. And as the Earth and Moon are both opaque Bodies, which borrow all their Light from the Sun, when either interposes, the other in some measure must be obscured. Hence the derivation of the word Eclipse from the *Greek* *ἔκλειπω* which signifies a fainting, or swooning away; so sick persons, when a death-like fainting or swooning came upon them, were said by the *Greeks* to fall into an Eclipse. In like manner the Moon's body seems to vanish and grow dark, when the Earth interposes and deprives

deprives her of the Sun's light, according to an ancient but celebrated Astronomer. *Privatio luminis in luna orta à diametrali terræ inter solem et lunam oppositione.* And *Suidas* in solar Eclipses ἡ τε ἥλιος ἐκλειψις ἐπιτοδὸς μέν ἐστι ἀπὸ τῆς σελήνης γίνεται. Which shews that so many hundred Years ago they had a perfect knowledge of the true cause of Eclipses.

Having premised thus much in general, I will now descend to a few particulars on each Luminary, and then proceed to the immediate Consideration of those two great Eclipses, the Occasion of my present writing.

But first of the Eclipses of the grand Luminary, that immense fountain of Heat, Light, and Fire in this planetary system of the Universe where we inhabit.

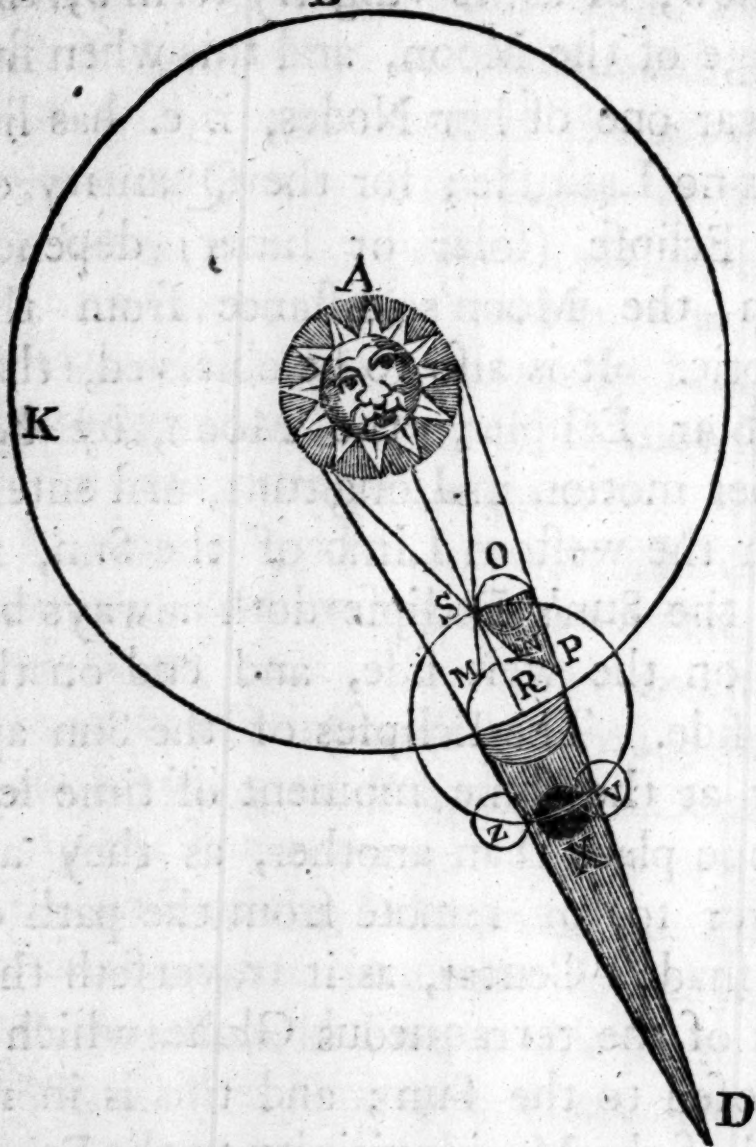
Solar Eclipses are caused (as observ'd above) solely by the Moon's interposition between the Sun and Earth; of consequence they demonstrate the Moon to be lower and much less than the Sun; nor can they ever happen but at
the

the new, or as its vulgarly term'd, the change of the Moon, and this when she is near one of her Nodes, i. e. has little or no Latitude; for the Quantity of any Eclipse (solar or lunar) depends upon the Moon's distance from the Ecliptic. It is also to be observed, that in solar Eclipses, the Moon, by her proper motion in Longitude, first enters upon the western Limb of the Sun, so that the Sun's Eclipse doth always begin on the west side, and end on the east side. The Eclipses of the Sun appear at the same moment of time less in one place than another, as they are nearer to, or remote from the path of the shade's Center, as it traverseth that part of the terraqueous Globe which is exposed to the Sun; and this is in regard of the Moon's vicinity to the Earth, her parvity to the Sun, and sudden change of her paralaxes in Longitude and Latitude.

But more fully to explain and illustrate this Doctrine, I have inserted the following figure.

Wherein

B



Wherein the letter A represents the Sun and Center of the World, B K R B the annual Orb of the Earth, R the Body of the Earth, S Z V S the Orb of the Moon, O the place of the Moon when she is in Conjunction with the Sun,

Sun, V X or Z her Place when she is in Opposition, D the conical Point of the Earth's shadow, which is greater or lesser, according to the Distance of the Earth from the Sun, Now by this figure it appears, that to him that stands upon the Earth at N, the whole Body of the Sun is hidden from his sight by the Interposition of the Moon at O; but to him that is at R, there is but half the Sun obscured; and lastly, to him that lives at M, there is no Part of the Sun hidden from him, but he at the same Instant may behold his whole Body free from any Interposition of the Moon, as the Figure very plainly represents.

Lunar Eclipses are caused by the Interposition of the Earth betwixt the Sun and Moon. Now this can never happen but when the Moon is at the Full; for then she is in Opposition to the Sun, and near the Earth's Shadow. And since there is a Full Moon every Month, it will be proper to give a Reason why there is not an Eclipse too;
C
and

and this I shall do in Sr. *Isaac Newton's* own Words: ' If (says he) the Moon's ' Orb lay in the Plain of the Earth's ' Orb, i. e. if those two Plains were to ' coincide in one Plain, passing through ' the Sun, there would be a total E- 'clipse of the Moon at every Full, and ' consequently a central Eclipse of the ' Sun at every Change. But the Orbs ' of the Earth and Moon being placed ' obliquely, and not both in the same ' Plain, intersect each other in two ' Points (called Nodes) where the ' Moon's Orb is found to make an An- 'gle of Inclination, or Geocentrick ' Latitude with the Ecliptic of five ' Degrees; therefore the Moon may be ' in such a Position from the Nodes, ' as to pass the Opposition above or ' below the Earth's Shaddow. Hence ' it is very possible every Full Moon ' may not be eclipsed; and farther it ' is plain, that no Eclipse can happen ' but when the Moon is near one of ' her Nodes, consequently the Quan- 'tity (as I observ'd before) of an Eclipse ' depends

‘ depends upon the Moon’s Distance from
 ‘ it; and may be total with Continuance,
 ‘ total without Continuance, Partial, or
 Central.’ Thus far the immortal *Newton*.

However this Doctrine of lunar Eclipses will best appear from the foregoing Figure of the Sun, for when the Moon is in exact Opposition of the Sun, and void of Latitude, she is placed in X, the Center of the Earth’s Shaddow, whereby she loseth the whole Light of the Sun by the direct Interposition of the Earth betwixt the Sun and her, so that she is totally eclipsed with Continuance; but if she be in the Points V or Z, than the Eclipse is Partial, and only a Part of her Body is darkened, as the Figure demonstrates.

But altho’ the Moon is deprived of the direct solar Beams; yet is she not absolutely hid from us at the same Time, because the Rays of Light retained in our Atmosphere, dart an oblique Reflexion into the real Shaddow, and thereby faintly illuminate the whole Cone: Consequently by this,

the Moon's Body remains lucid and visible to us; tho' at the same Time it is in what we call a Total Eclipse.

I shall now, as at first proposed, proceed to the Consideration of the approaching great Eclipse of each Luminary; treating of them in the same Order as they happen.

The First is of the Moon, on *Thursday* the 9th Day-of *September*, 1736, in the Morning. According to the following Calculation it will appear to the Inhabitants of the famous City of *London*.

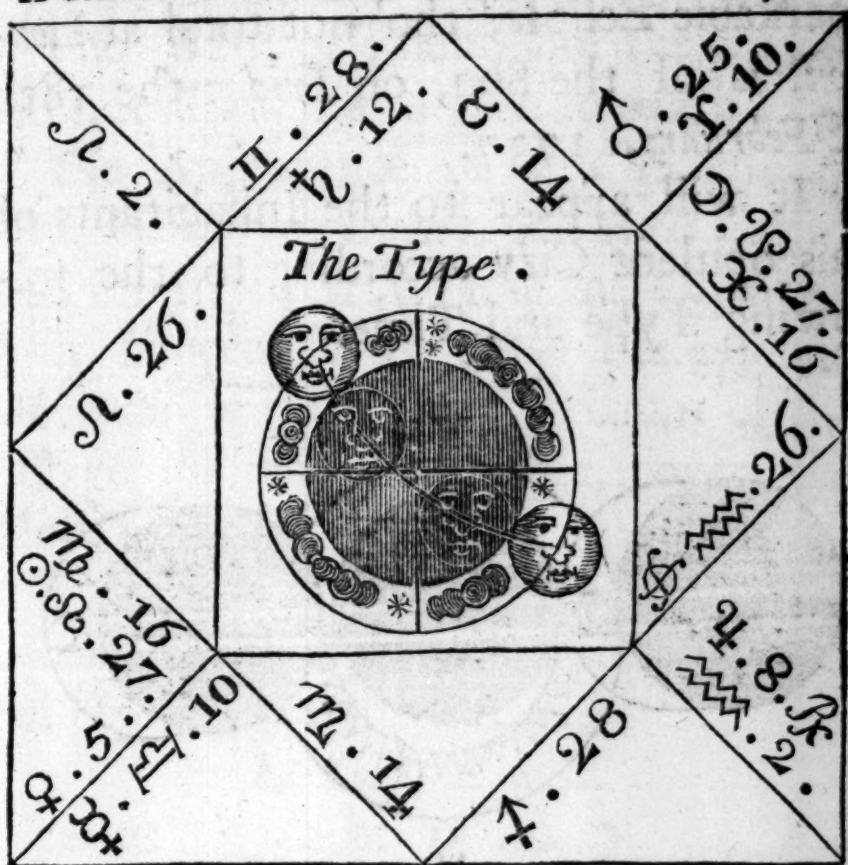
M O R N I N G.

	Hours.	Min.
To begin at -- -- -- --	0	57.
Beginning of total Darknefs --	2	5.
Middle of the Eclipse - -	2	56.
End of total Darknefs - -	3	48.
End of the Eclipse -- --	4	55.

This Eclipse will continue near Four Hours; the total Darknefs will continue one Hour and forty three Minutes, and
is

is nearly central, as appears by the following Type.

A Scheme of Heaven at the Middle of the Eclipse.

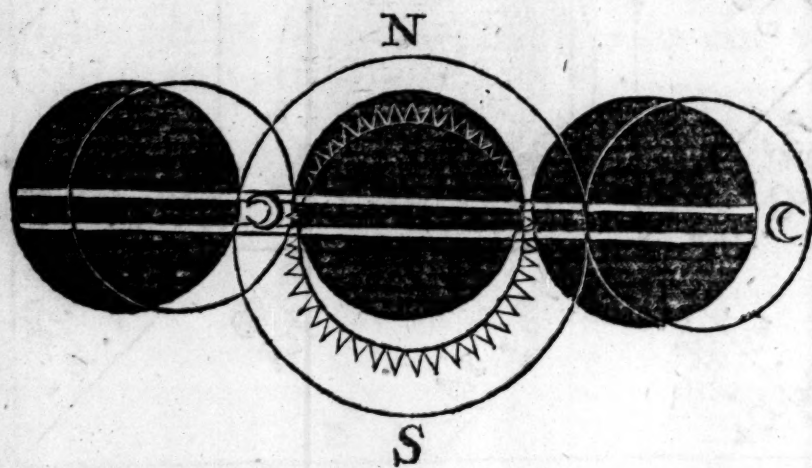


Which I have the rather inserted, because it not only explains the Phenomenon exactly as it will then appear; but it will oblige all those that are Astrologically inclined, who pretend (with what Reason is not my Business to enquire) to form a Judgment of Fu-
turity from the various Positions, As-
pects,

pects, and Configurations of the Planets at the Middle of an Eclipse.

The Second, and indeed most remarkable Eclipse, tho' not total at *London*, is of the Sun, on *Friday* the 18th of *February*, 1737.

It will appear to the Inhabitants of this opulent City according to the following Type and Time.



Beginning at	2 h. 29 m.	} Afternoon.
Middle	3 h. 46 m.	
End	5 h. 2 m.	

Digits Eclipsed 10 13. i. e. somewhat more than 10 Parts in 12 of the Sun's Body will be hid from our Sight by the dark Globe of the Moon passing between us and the Sun, as appears by the

the

the Type. A glorious and wonderful Phenomenon, the like whereof will not appear to this City until *July*, 1748.

Tho' Want of Room, and the Charge will not allow me to give an exact Type of the Appearance of this Eclipse at *York, Edinburgh, Dublin, and Paris*; yet I shall insert the true Time and Quantity as it happeneth at these Places, and conclude with a brief Account of the Passage of the Penumbra, over the Globe of Earth.

To those that live North-West from *London*, this Eclipse will appear larger, and begin somewhat earlier.

At *York*, it will

Begin at	2 h. 13 m.	} Afternoon.
Middle at	3 h. 39 m.	
End at	4 h. 58 m.	

Digits Eclipsed 10 59.

At *Edinburgh*, the Sun will appear centrally eclipsed, and a Thread of the Sun's Light may be seen round the dark Body of the Moon, to the agreeable Surprise of every curious Spectator of that beautiful and uncommon Phenomenon,

phenomenon, which will

Begin at	2 h. 4 m.	} Afternoon.
Middle at	3 h. 28 m.	
End at	4 h. 47 m.	

Digits Eclipsed 11 36.

At *Dublin*, the Metropolis of *Ireland*, it will

Begin at	1 h. 45 m.	} Afternoon.
Middle at	3 h. 16 m.	
End at	4 h. 39 m.	

Digits Eclipsed 11 10.

Paris in *France* being South of us, it will appear less to them, according to the following Calculation,

Beginning at	2 h. 40 m.	} Afternoon.
Middle at	4 h. 7 m.	
End at	5 h. 21 m.	

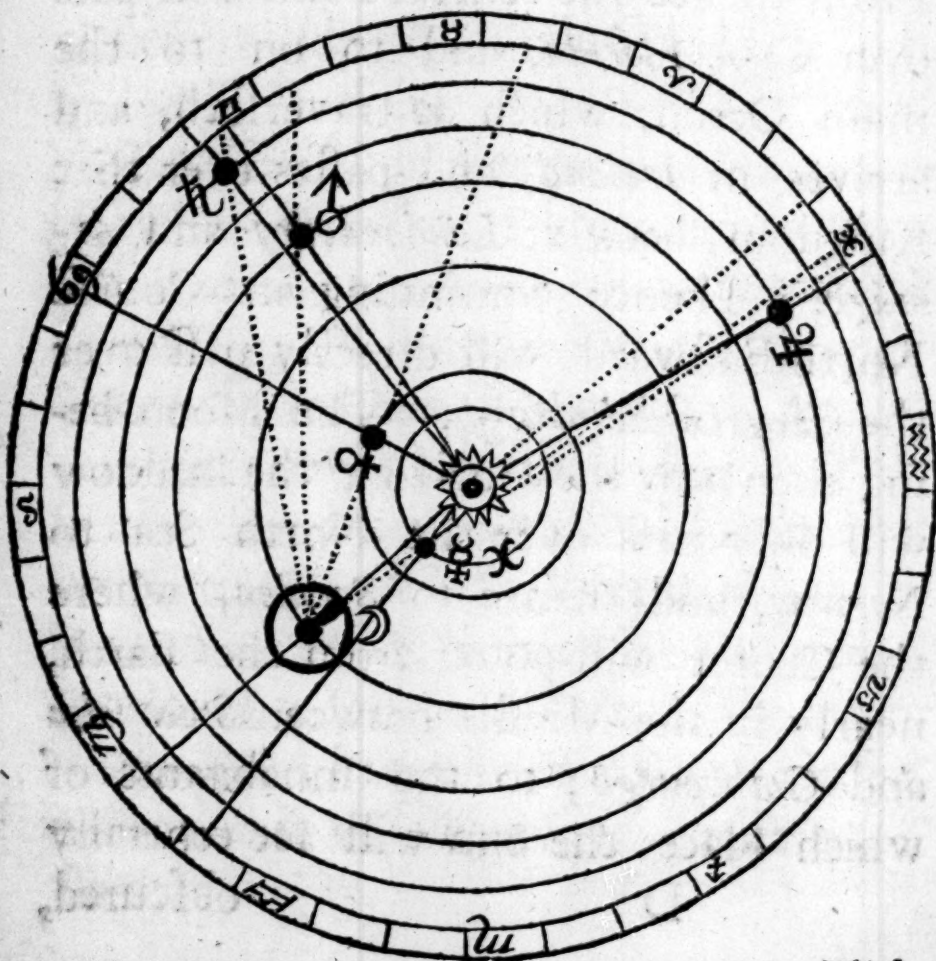
Digits Eclipsed 9 20.

The Penumbra first takes the Earth in *New-Spain*, in *North-America*, near *Cape Higexas*, where the Moon's lower Limb will just touch the Sun's upper at his Rising. From thence it will spread itself over all the Country of the *Amazons*, and over the Bay of *Mexico*, *Florida*, and the *Caribbe Islands*, the Inhabitants

bitants whereof will see more or less of the Sun's Body obscured, according as they are situate nearer to, or farther remote from the Center (as was observ'd above) which will soon enter upon the Disk, near the Meridian of *Mexico*, Lat. 26 North. There the Sun will be seen to rise centrally eclipsed; and (as I observed at *Edinburgh*) round the Moon's Body will appear a bright luminous Circle, or Thread of Light. From thence the central Point will pass over *Cape Florida*, and so on to the main Ocean, which it traverseth, and arrives in *Ireland*, and passes over that Kingdom betwixt *Londonderry* and *Armagh*. Thence continuing its Course North-Eastward will directly pass over the City of *Edinburgh*. The Moon being then near the Horizon, the shadow will only pass over the North Sea to *Norway*, and thence to *Sweden*, where the Center will go off from the Earth, nearly in the Middle between *Stockholm* and *Gothbourgh*; to the Inhabitants of which Places the Sun will set centrally obscured,

obscured, with the above mentioned shining Ring round the Moon's Body. Lastly, on the North Coast of the Mediterranean-Sea, not far from *Barcelona*, having over-run all *Europe*, the North Parts of *Africa*, and Part of *Asia*, the Penumbra intirely leaves the Earth, and with the setting Sun ends the general Eclipse.

I shall now speak a few Words on the Pythagorean System.



This

This is called the Pythagorean System, from *Pythagoras*, who first gave Demonstration of the Sun's being the common Node and Center of the Universe. But the true Figure and Image of the World, with its just Lineaments was first described by *Aristarchus Samius*, who did maintain *Stellas fixas et solem non moveri, Terram circa solem in medio circuli jacentem in orbem verti, Eclipticam comparatione fixarum instar puncti esse; atque ideo Terram videri in Mundi Centro quiescere*. And tho' this Hypothesis was most evidently true; yet, in those ancient Times, it either did not receive universal Assent, or was soon overshadow'd and forgotten; for we find it lay dormant until the Time of *Nicholas Copernicus*, of *Thorn* in *Poland*, who reviv'd, and by astronomical Demonstration, did sufficiently confirm it, according to the Figure, wherein it appears the Sun is the Center of the lower World, which is the undoubted Point of his Situation, and a Place that he may justly challenge in Respect of his Office: Agreeable to the excellent

Kepler,

Kepler, Nam si totus mundus qui sphericus est, indiget solis lumine et colore Æqualiter; optimum igitur, solem in medio esse, unde equaliter ista in omnes mundas plagas dispersiatur; quod fit equaliliter et rectius, quiescendo in centro, quam circumeundo circa illud.

Above the Sun, in the first Orb next the Center, is placed Mercury, who, by Reason of the Parvity of his Circle, doth accomplish his Revolution through the Zodiack in 88 Days.

In the next Sphere moves Venus, who runs her Period thro' the 12 Signs of the Zodiack in 225 Days.

The Earth is in the Middle of the planetary Orbs, running her Course about the Sun in a Year; about the Earth in the Sphere of the Moon, who performeth her Course in a Month.

Next above the Earth wheels Mars, whose Orb (being larger than the Earth's) he perambulates in 2 Years.

Next follows Jupiter, who performeth his Revolution in 12 Years.

And lastly, in the highest Orb is Saturn, who finisheth his Period in 30 Years.

Having

Having taken this short Survey of the planetary Orbs, and ascended from the Center to the Circumference, I am now wholly at a stand to behold the vast Distance of the fixed Stars, which is so exceeding great, that they are altogether void of Parallax of the annual Orb; so that to obtain their exact Distance, is without the Reach of Man's Apprehension: However the great outward Circle represents the Zodiack, or eighth Sphere, in which the 12 Signs are placed according to their natural Order; and that I may better explain the System, I have applied the Places of the Planets heliocentrically and geocentrically to the middle Time of the great solar Eclipse on *February* the 18th, 1737, which doth beautifully explain that wonderful Phenomenon, and facilitates my first Intention of accounting for the apparent Retrogradations of the Planets, and also their respective Places in the Zodiack, as seen from the Sun and Earth.

The true, or Heliocentrick Place, as seen from the Sun, is distinguished by a
black

black Line drawn from the Center of the Sun through the Body of the Planet to the Zodiack; and the Geocentrick, or apparent Place, as seen from the Earth, is distinguished by a prick'd Line drawn from the Earth's Center through the Body of the same Planet, likewise to the Zodiack. Now the Angle made at the Planet by the Intersection of the said Lines, is called the Parallax of the annual Orb; which, Angle, as it increaseth and diminisheth in Respect of the mutual Position of the Planet and the Earth, their Separation one from another, and applying one to another, is the sole Reason that the Planets appear direct, retrograde, and stationary, sometimes near the Earth, and sometimes far remote, as in the Figure, where the true Place of Saturn, as seen from the Earth, is 5d. 31m. in Gemini; but seen from the Sun, he will appear some Degrees further on in that Sign, as is most apparently shewn by the black Line drawn from the Sun through his Body to the Zodiack. And that you
may

may know whether Saturn be direct or retrograde, you may see it plainly by the Figure, by ocular Inspection only; for the Earth moving swifter than Saturn, the Line drawn from the Earth through his Body, will make him appear every Day further and further in the Zodiack, till such Time as the Earth comes to Aries. At which Time he will seem stationary for some Days, and then be apparently retrograde until the Earth enters the Sign Virgo, when he will again appear direct. The true Reason and Ground whereof you may perceive by the very Scheme; therefore shall enlarge no further on the Superiors; but at once descend to the Planet Mercury, who happens to be apparently retrograde at the Time of this Eclipse, as is demonstrable by his Position in the Figure, where he is geocentrically in 4d. 16m. in Pisces; but his heliocentrick or true Place, is in 22 of Virgo. Now his Motion being much swifter than the Earth, the Line drawn from thence through his Body, as he perambulates his proper

proper Orb, will daily appear in fewer Degrees of Pisces; and about the 24th of *February*, he will be seen in Aquarius, nearly stationary, being then arriv'd at the Letter X in his own Orb; and from thence forward, the same Line drawn from the Earth through his Body will appear to move in a direct Order of the Signs, until he geocentrically approacheth the 16th Degree of the Sign Cancer on *June* the 8th (the Earth being then in 28 Degrees of Sagittarius) when he will once more appear retrograde, as is very obvious, even to the meanest Capacity.

These two Examples being sufficient for all the rest, as they are subject to the same Laws, I shall enlarge no farther.

But proceed to enquire into the Nature and Laws of Comets, and see whether there be any good Grounds to expect (as is the vulgar Notion) the speedy Appearance of such a Phenomenon.

The most famous Philosophers and Astronomers of the World in all Ages
(until

(until the last Century) were mightily perplexed in Regard of Comets, every one conjecturing differently, and many very absurdly, as to their Nature; but all ignorant of the Laws of their Motion.

Aristotle would have them to be nothing else but sublunary Vapours, or Airy Meteors, floating with uncertain Motion in the *Æther*. Several of the ancient *Italians* call them Wandering Stars, that don't appear unless after a long Time, and are seen but a small Time; but that they might say of the planet Mercury, being then ignorant of his Motion. *Plutarch* reports much the same Thing of the Pythagoreans, in his Third Book of Philosophical Opinions. And *Diodorus Siculus*, who tells us that the ancient *Ægyptians* and *Chaldeans*, were able to predict the Apparition of Comets, Earthquakes, Tempests, &c. betrays his Ignorance in reporting what was merely the Astrological Jargon of those antiquated Triflers. *Seneca* indeed tells us, that *Appollonius*, the *Myndian*,
E
used

used to say, That a Comet was a Star, or celestial Body, as the Sun or Moon; but that he did not know its Course, because it cuts through higher Parts of the World, and then at last appears, when it comes to the Bottom of its Course. Of this Opinion *Seneca* professes himself to be, in these Words; 'I do not think a Comet to be a sudden Fire, but one of the eternal Works of Nature.' And truly this Philosopher said and did more towards clearing this Point, than all the Ancients put together; for he having observed and consider'd the Phenomena of two remarkable Comets of his Time, made no Scruple to place them amongst the celestial Bodies, believing them to be Stars of equal Duration with the World, tho' he was not so happy as to find out the Laws of their Motion, no more than several others who have laudably attempted it since his Time, particularly *Nicephorus*, *Gregoras*, *Regiomontanus*, *Tycho Brahe*, and the sagacious *Kepler*; which last indeed made some considerable

ble Progress therein; for he declared that the Comets moved freely through the planetary Orbs, with a Motion not much different from a Rectilinear one; but of what Kind he could not possibly determine. For That, notwithstanding the excellent Endeavours of *Hevelius*, was the happy Fortune of the immortal *Sr. Isaac Newton*, assisted therein by the greatest and most excellent Astronomer now living; I mean the incomparable *Dr. Halley*, from whose joint Doctrine and curious Observations we may gather, that a Comet is a celestial Body, somewhat of the Nature of the Planets, tho' moves in a quite different Orbit, and perhaps inhabited as they in all Probability are; for the Tail of a Comet (notwithstanding its frightful Appearance to us) is nothing else but a very thin Vapour, which the Head or Nucleus of the Comet sends out, by Reason of its Heat when approaching that immense Fountain of Light and Fire the Sun. And as to their Motion, *Sr. Isaac Newton* proved, in that prodigious Comet
of

of the Year 1680, that it moved round the Sun in a parabolical Orb, and described Area's (if taken at the Center of the Sun) proportional to the Times. So likewise the most sagacious Dr. *Halley* conjectures that they move in very excentric ecliptic Orbits, and make Returns after long Periods of Time. Nay, that most indefatigable and royal Observer has, with prodigious Labour, not only given us the astronomical Elements of the Motions in a parabolic Orb of all the Comets that have been hitherto duly observ'd; but has favour'd us with a general Table for calculating the Motions of Comets in a parabolical Orbit, of great Service to Cometical Astronomy in general, and to find the Return of Comets in particular. However, notwithstanding the vulgar Notion at present, we expect no Return of any Comet until the Year 1756.



F I N I S.